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THE INTERNATIONAL PHYTOGEOGRAPHIC EXCURSION IN AMERICA*

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During the summer of 1913 it was the privilege of the writer to participate in the International Phytogeographic Excursion in America. This excursion was organized and conducted by Professor H. C. Cowles, of Chicago, to whom too much credit cannot be given for his careful planning and efficient leadership. The personnel of the party included ten Europeans and seven Americans. The foreign members were Professor Adolf Engler, of Berlin; Professor C. von Tubeuf, of Munich; Professor C. Schröter, Dr. E. Rübel, and Dr. and Mrs. H. Brockmann-Jerosch, of Zurich; Mr. and Mrs. A. G. Tansley, of Cambridge; Dr. O. Paulsen, of Copenhagen; and Professor T. J. Stomps, of Amsterdam. The American members, besides Professor Cowles and the writer, were Professor and Mrs. F. E. Clements, of Minneapolis; Professor and Mrs. A. Dachnowski, of Columbus; and Dr. G. D. Fuller, of Chicago. The excursion was joined by other American botanists in various parts of the country, and some of these accompanied the party for one or two weeks. Altogether the excursion was participated in by nearly two hundred. The expedition left New York, westward bound, on July 30, and the route traveled during the succeeding ten weeks is indicated on the map (fig. 1.) A short account of the trip is here given, together with some reference to the more salient features of the vegetation encountered.† Attention is confined chiefly to the botanical side of the excursion, but it need hardly be remarked that the hospitable reception accorded the party

* Contribution from the Osborn Botanical Laboratory.

† A more detailed account is being published by Tansley in the *New Phytologist*.

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all along the route, and particularly the enthusiastic coöperation of botanists in the various regions visited, contributed very materially to the success and enjoyment of the trip.

Although the excursion was formally organized at Chicago, before leaving the east a number of short trips were taken to localities of botanical interest in the vicinity of New York.



FIG. 1. Map showing route followed by I. P. E. in the United States.

An afternoon was spent near Hempstead, Long Island, where the principal attraction was the peculiar natural prairie described by Harper.* To the Europeans; however, the sandy swamps proved equally entertaining. A two-day jaunt into southern New Jersey afforded an opportunity to study the extensive salt marshes about Barnegat and the pine barren flora in the neighborhood of Warren Grove. In this latter locality the three types of vegetation so characteristic of the barrens are well represented, viz: the forests of *Pinus rigida*, *Quercus marilandica*, etc., the pigmy forests of the "plains"—the home of *Corema Conradii*, and the cedar (*Chamæcyparis thyoides*) swamps with their unique assemblage of rare plants.† A half day each was devoted to the

* Harper, R. M. The Hempstead Plains of Long Island. *Torreyia* 12: 277-286. fig. 1-7. 1912.

† For further description, see Stone, W. The plants of southern New Jersey, with especial reference to the flora of the pine barrens. *Ann. Rept. New Jersey State Mus.* 1910: 25-828. pl. 1-129 + fig. 1-5 + map.

Brooklyn Botanic Garden and the New York Botanical Garden. The beautiful hemlock grove in the Bronx Garden gave the visitors their first glimpse of the climax forest of the east.

Except for a stop at Niagara Falls the journey to Chicago was uneventful. Chicago lies in the transition area between the forested region of the east and the prairie region of the middle west, and the distribution here of forest and prairie is influenced largely by edaphic factors. On the uplands forests occupy the glacial moraines and the beaches of the former Lake Chicago; the rest of the country is grassland.* During the week here visits were made to prairies and oak-hickory (*Quercus* sp., *Hicoria* sp.) forests near the city, to clay bluffs and ravines along the lake north of the city, to a tamarack (*Larix laricina*) swamp in northern Indiana, and to a magnificent tract of virgin beech-maple (*Fagus grandifolia*, *Acer Saccharum*) forest in southern Michigan—a forest much like those of southern New England in its general aspect, but of a more mesophytic type than those west of Lake Michigan. The real drawing card in this region, however, is the sand-dunes which fringe almost uninterruptedly the eastern margin of Lake Michigan, continuing around the southern end of the lake and along the western shore as far as Chicago. Two entire days were devoted to the study of this fascinating area, whose vegetation has been so graphically portrayed by Cowles.†

The excursionists left Chicago on the evening of August 8, and arrived in Lincoln, Nebraska, on the following morning. The country about Lincoln is one of rolling prairies with tortuous lines of trees fringing the streams. These stream forests, best developed on the flood plains, represent the westernmost extensions of the deciduous forests of the east. Once the eastern botanist, westward-bound, has left these behind, he has severed, so to speak, the last familiar tie. The prairies themselves in their midsummer aspect are depressing. A hasty survey of the region

* For further discussion see Cowles, H. C. The physiographic ecology of Chicago and vicinity. *Bot. Gaz.* 31: 78-108, 145-182. 1901.

† Cowles, H. C. The ecological relations of the vegetation on the sand dunes of Lake Michigan. *Bot. Gaz.* 27: 95-117; 167-202, 281-308; 361-391. *fig. 1-162.* 1899.

about Lincoln was made in automobiles, but lack of time and intense heat precluded anything resembling careful study.

That evening the party continued the journey, stopping next at Akron, Colorado, 400 miles west of Lincoln. Akron lies in the midst of the Great Plains. North and south, east and west, as far as the eye can reach, stretches a vast, featureless expanse of grassland. Two most interesting days were spent here. The first of these was occupied by an eighty-mile automobile ride across the plains, to and from the sand hills, with frequent stops. The second day was spent about the United States Dry Land Experiment Station. The prevalent type of vegetation on the plains proper, as contrasted with the sand hills, consists largely of various species of *Bouteloua*, *Buchloë*, and *Aristida*, and is commonly spoken of as short-grass. The short-grass associations, together with those characteristic of the sand hills, have been fully discussed by Shantz.*

Two days were next occupied along the eastern border of the Rocky Mountains—at Palmer Lake and near Colorado City—studying the vegetation of the tension zone between forest toward the west and grassland toward the east. In the invasion of grassland by forest the advance guard is usually a thicket in which *Quercus Gunnisonii* commonly is dominant. The thicket stage may be followed by *Pinus edulis* and *Juniperus scopulorum*, but more often, as in the Garden of the Gods, the two stages are telescoped. On the ridges and hills the pinyon and juniper in many places are becoming supplanted by *Pinus ponderosa scopulorum*.

Eight days were devoted to the exploration of the region about Pikes Peak, headquarters during this period being at Minnehaha-on-Ruxton, about halfway up the cog railway to the summit of the peak. Although in certain respects not typical of the area as a whole, this region gives one a very fair conception of the general nature of the forests of the Rocky Mountains, and of the way in which vegetation here is modified as a result of differences in exposure and altitude. The climax forest in the

* Shantz, H. L. Natural vegetation as an indicator of the capabilities of land for crop production in the Great Plains area. U. S. Dept. Agr. Bureau of Plant Industry Bull. 201. 1911.

vicinity of Minnehaha (altitude 8,000 feet) consists principally of *Pseudotsuga taxifolia* and *Picea Engelmanni*. The former predominates at lower, the latter at higher elevations. Such forests may become quite mesophytic and are best developed on



FIG. 2. I. P. E. on dunes at Sawyer, Michigan. From left to right: (standing) Dr. Brockmann-Jerosch, Dr. E. N. Transeau, Professor H. C. Cowles, Professor O. W. Caldwell, Mr. A. G. Tansley, Dr. O. Paulsen, Mrs. A. G. Tansley, Professor C. Schröter, Professor A. Dachnowski, Professor J. M. Coulter, Mrs. H. Brockmann-Jerosch, Professor T. J. Stomps, Professor C. von Tubeuf; (seated) Dr. G. D. Fuller, Dr. E. Rübél. Top branches of dune-buried oaks in background.

north slopes. South slopes, on the other hand, are usually covered with a more xerophytic, open type of forest in which *Pinus ponderosa scopulorum* and *Pinus flexilis* are the characteristic trees. Gravel slides in all stages of forestation are a prominent feature in the neighborhood of Minnehaha.* The day selected for the ascent of Pikes Peak was cold, wet and disagreeable,

* See Schneider, E. C. The distribution of woody plants in the Pikes Peak region. Colorado Coll. Publ., Science Ser. 12: 137-170. Map. 1909. Also the succession of plant life on the gravel slides in the vicinity of Pikes Peak, *loc. cit.*, 12: 289-311. fig. 1-6. 1911.

and the top of the mountain was covered with snow. Much more interesting from a botanical standpoint was the excursion up Mount Garfield (altitude 12,365 feet), for which two days were set aside. Engelmann spruce continues as the dominant tree up to an elevation of about 11,300 feet, where it gives way to *Pinus aristata*, the characteristic timber-line tree. "Krummholz" forms of both these trees are common in certain localities. On Mount Garfield, as on other peaks of sufficient elevation, timber-line as a rule is sharply defined, and the alpine vegetation of the rocky meadows above is in marked contrast to that of the forests below. The alpine gravel-slides with their curious growth of "cushion-plants" are especially unique.

The next stopping-place, after leaving Minnehaha, was Salt Lake City, Utah, where parts of two days were spent examining tracts of vegetation in the proximity of Great Salt Lake. As might be anticipated, the natural vegetation of this desert country is not very diversified. Sage-brush (*Artemisia tridentata*) dominates nearly everywhere on the fresher soils, while alkaline soils are populated by species of *Sarcobatus*, *Kochia*, *Atriplex*, and various herbaceous halophytes.*

The journey from Salt Lake City to Tacoma, Washington, was broken by a brief stop at North Yakima, Washington, to note the marvelous results that have been achieved in this territory by irrigation. Of the six days allowed for western Washington, the five spent in the vicinity of Mount Rainier to the writer represent the most enjoyable part of the entire trip. Two days were devoted to forests in the neighborhood of Kapowsin and the National Park Inn, and two more were spent about Camp of the Clouds. Nowhere in the world is there found a more magnificent display of coniferous forest than here in the Pacific Northwest. The most characteristic tree of the humid forests along the western slopes of Mount Rainier, and of the lowlands of Washington, is *Pseudotsuga taxifolia*, which here attains enormous dimensions. Associated with this as im-

* For detailed description of the region visited see Kearney, T. H., Briggs, J. L., Shantz, H. L., McLane, J. W. and Piemeisel, R. L. Indicate significance of vegetation in Tooele Valley, Utah. Jour. Agr. Research 1: 365-417. pl. 43-48 + fig. 1-13 + map. 1914.

portant constituents of the forest are *Tsuga heterophylla* and *Thuja plicata*. Among the most conspicuous shrubs in the rank, luxuriant undergrowth are *Echinopanax horridum*, *Acer circinatum*, and *Gaultheria Shallon*. Seedlings of various trees germinate everywhere on fallen logs; there is a wealth of ferns; while rocks, ground, logs, and trees are covered with mosses.

The ecological resemblance between this forest and certain forests in the east, *e. g.*, those of northwestern Connecticut, is striking. Not only is there a similarity in their general aspect, in the mesophytic nature of the undergrowth, etc., but the likeness is further emphasized when a detailed analysis of the flora of the two is made. To be sure, the Douglas spruce is lacking in the east, beech and chestnut in the west, but hemlock is present in both places. *Betula lutea* is absent from the western forest, but *Alnus oregana* may be considered its ecological equivalent. The eastern *Acer pennsylvanicum* finds its counterpart in the western *A. circinatum*; *Taxus canadensis* of the east easily corresponds to *T. brevifolia* of the west, *Cornus Florida* to *C. Nuttallii*; and so on. Moreover, many herbaceous species are common to both, *e. g.* *Lycopodium lucidulum*, *Cornus canadensis*, *Linnaea borealis*, and *Chimaphila umbellata*, while the species of *Clintonia*, *Trillium*, *Maianthemum*, *Tiarella*, *Oxalis*, and other genera characteristic of the eastern forest are closely paralleled by very similar species here in this western forest.

Proceeding upward from National Park Inn there is a gradual change in the composition of the forest, until at an elevation of 4,500 feet it consists largely of *Tsuga heterophylla*, *Chamaecyparis nootkatensis*, and various species of *Abies*. There is no distinct timber-line on Mount Rainier. Camp of the Clouds, in the Paradise Valley (altitude 5,550 feet), lies in the midst of a lovely mountain park where scattered clumps of trees—mainly *Abies lasiocarpa*—alternate with alpine meadows. The meadows below the camp are a veritable garden, whose brilliant floral display was said by the Swiss members of the party to equal even that of their own Alps.

Returning to Tacoma, some of the party visited the "oak-openings" in the neighborhood of Spanaway Lake, while others

took in the kelp-groves near Point Defiance. Further opportunity to study the forests of the northwest was given at Medford, Oregon, where for three days the excursionists were guests of the Medford Commercial and University Clubs. The principal attraction here was Crater Lake, situated eighty miles northeast of Medford at the crest of the Cascade Mountains, and regarded by geologists as one of the wonders of the world. The journey



FIG. 3. From left to right: Professor C. Schröter, Professor A. Engler, Dr. E. Rübel. Photograph taken near Minnehaha by Dr. H. L. Shantz.

from Medford to the lake was made by automobile. En route, there were traversed first the fertile agricultural lands of the Rogue River valley (altitude about 1,400 feet), where the natural vegetation consists mainly of grassland alternating with oak (*Q. Garryana*, *Q. californica*) and chaparral. The foothills are sparsely timbered with *Pinus ponderosa* and oak. With increasing elevation the forest becomes denser, and thirty-five miles from Medford the road enters the Crater Lake National Forest, which is heavily timbered with *Pinus ponderosa*, *P. Lambertiana*,

Pseudotsuga, and *Libocedrus decurrens*. At still higher levels occur nearly pure growths of *Pinus Murrayana*, while about Crater Lake (altitude 6,000–8,000 feet) are subalpine forests of *Tsuga Mertensiana*, *Abies magnifica*, *A. lasiocarpa*, etc.

Leaving Medford, the party journeyed directly to the Yosemite National Park, via San Francisco. Upon entering the foothills of the Sierras, after crossing the grassy San Joachim Valley, the most striking difference in the vegetation, as compared with that farther north, is seen in the presence of *Pinus Sabiniana*, one of the most distinctive Californian conifers. The first night in the Sierras was spent at El Portal. From here the party traveled by stage to the Yosemite Valley, thence to Wawona and the Mariposa big-tree grove. A stop of a day and a half was made here. On the return trip to El Portal a night was spent at Glacier Point, which commands a splendid view of the Yosemite Valley. The chief features of botanical interest in this region are the Sierran forests and the big-tree (*Sequoia gigantea*) groves. Like practically all forests west of the Great Plains, those characteristic of the high Sierras, and magnificently developed in the vicinity of Wawona, are coniferous. The largest and most conspicuous tree is *Pinus Lambertiana*, with which are associated *Libocedrus decurrens*, *Abies concolor*, *Pinus ponderosa*, and *Pseudotsuga*. The shrubby undergrowth is mainly chaparral. The big-tree occurs in scattered groves, usually intermixed with other trees, and only rarely forms pure stands. The excursionists remained for the better part of a day in the Mariposa grove, wandering about like Lilliputians in the land of Brobdingnag.

In the vicinity of San Francisco a profitable day was spent on Mount Tamalpais with its evergreen-scrub forest of chaparral, and in Muir Woods where the acquaintance was made of *Sequoia sempervirens*.

The objective point of the excursion upon leaving San Francisco was Tucson, Arizona. But the thousand-mile railway journey was interrupted by several stops, notably at Monterey, the home of *Cupressus macrocarpa* and the center of one of the most remarkable communities of endemic plants in existence, and at Mecca, where studies were made of succession along the margin of Salton Sea.

So much has been written regarding the vegetation of the Tucson region* that it is hardly necessary to attempt any account in this connection. During their five days' stay here the members of the party were royally entertained, practically every expense being defrayed by the Carnegie Desert Laboratory. Never had the writer realized that a desert could be such a congenial habitat. The first day was occupied by an examination of the laboratories and their environs. On the second the excursionists were driven in automobiles eighteen miles across the desert to the foot of the Santa Catalina Mountains. That night they encamped in the midst of a grove of oaks and junipers 2,500 feet higher and 30 degrees colder than the distant plain. From this base camp trips were made to higher levels. All of the party climbed to Bear Canyon (altitude 6,000 feet) and several ascended Mount Lemmon (altitude 9,150 feet).

Two days at the Grand Canyon marked the culmination of the I. P. E. From a standpoint of botanical interest the most noteworthy feature here is the zonal distribution of the vegetation on the sides of the canyon. At the top is an open, park-like forest of *Pinus ponderosa*, *P. edulis* and *Juniperus monosperma*. Immediately below the rim occur *Pseudotsuga* and *Abies concolor*, but farther down these are superseded by pinyon and juniper. About halfway to the bottom of the canyon is a plateau covered with an almost pure growth of *Coleogyne ramosissima*, while at the level of the river vegetation is scant and extremely xerophytic, *Ephedra* sp. being the most characteristic plant.

Stops for study in the pine forests of eastern Texas and in the region about New Orleans had been contemplated, but extensive floods made it necessary to abandon this part of the program. At New Orleans the party disbanded, most of the European members returning to New York via Washington.

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* See especially Spalding, V. M. Distribution and movements of desert plants. Carnegie Inst. Publ. No. 113, pp. 1-144. *pl.* 1-31. 1909.